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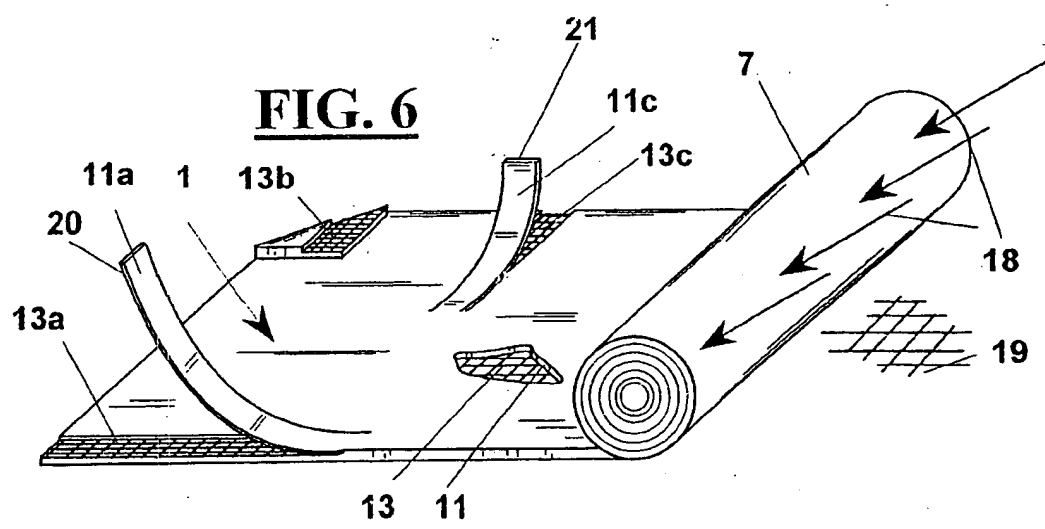
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(54) Method for making a bituminous coating with electrical and/or magnetic effect, bituminous coating thus obtained and use thereof

(57) The coating (1) comprises a matrix (11) of bituminous material in which a layer of conductor material (3) is embedded. The conductor material (3), which can be a metal net (13) obtained by knitting or weaving a conductor wire, or a thin perforated and stretched metal sheet, has portions that can be uncovered (13a, 13b, 13c) for being connected to corresponding portions of an adjacent coating (13a, 13b, 13c) or to another exter-

nal conductor or to a voltage supply (53) or to ground (32,42). The coating can be used for waterproofing surfaces of buildings and shielding them from electromagnetic radiation, such as for example those generated by TV or cellular telephonic antennas, high voltage lines, etc. Furthermore, it can be used for other electrical and/or magnetic functions such as for shielding metallic structures, ducts, etc. from stray currents or for providing magnetic guides on industrial and road surfaces.

FIG. 6



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Description

Field of the invention

[0001] The present invention relates to the field of civil engineering and more precisely it relates to a method for making a bituminous coating with electrical and/or magnetic effect.

[0002] Furthermore, the invention relates to a bituminous coating thus obtained.

[0003] In particular, the invention relates to a system for shielding surfaces of buildings from electromagnetic radiation by means of said coating, such as for example those generated by TV or cellular telephonic antennas, high voltage lines, etc.

[0004] Even if not exclusively, the invention relates to a bituminous coating for waterproofing horizontal surfaces of buildings such as foundations, roofs, terraces, etc. and shielding them from electromagnetic waves.

[0005] Always in particular, but not exclusively, the invention relates to a system for shielding by means of said coating metallic structures, ducts, etc. from stray currents, which cause serious damages for corrosion.

[0006] Furthermore, always not exclusively, the invention relates to a system for providing magnetic guides by means of said coating, in the industrial and road fields.

Background of the invention

[0007] The problem is felt of shielding houses and offices from electromagnetic waves, whose negative effects on health and on well-being, notwithstanding not yet completely understood, are feared by people.

[0008] In particular, houses and offices are the places where people spend most of time, and then where the exposition is the largest.

[0009] New buildings have always thin walls, even if rugged enough, and are substantially permeable to electromagnetic waves.

[0010] In particular, roofs of buildings often support repeaters or other antennas that emit electromagnetic waves, whereby inhabitants are more exposed to this type of radiation. Near buildings there are sometimes high voltage lines, that create intense and variable electric and magnetic fields.

[0011] Another problem is that of the stray currents, which cause corrosion and then breakage of metal structures, ducts, etc. Such currents are produced by devices linked to the structure or they circulate in the ground surrounding the structure owing to adjacent electric plants. Corrosion of the metal appears in the points where the currents are transferred.

[0012] Concentrated corrosion can cause damages and perforation or initiation of fracture in tubes. Steel structures surrounded by ground are subject to this phenomenon as well, that causes damages thus requiring expensive maintenance and prevention systems.

[0013] A further problem is to provide magnetic guides on roads or on industrial paths. Usually, they are formed by electric cables laid underground or under road surfaces, for example under the centre or the side lines of roads. Such magnetic guides have the function of guiding a vehicle without driver, for example inside industrial plants, or alerting a driver of a car that is suitably equipped with appropriate electronic apparatus of the passage beyond the centre line or the side line of a road or of the presence of a bend. However, the road works for laying underground cables are expensive, they weaken the road surface and obstruct traffic.

[0014] The bituminous membranes are bituminous coatings customarily used for waterproofing and insulating surfaces. They are normally made in the form of sheets or rolls. The membranes are heated by fire at the moment of their application, and the coating obtained lasts a long time. Their composition can be varied according to their application; depending if, for example, they are used to cover roofs of buildings, walkways or roadways, structures to be waterproofed. Other bituminous coatings are obtained by lining directly surfaces with layers in turn of bitumen and of stiffening material. The latter membranes are made directly on place.

[0015] The waterproof bituminous membranes are normally made with addition of reinforcement material, for example glass fiber or polyester fiber, embedded between two layers of waterproof material made of elastomeric or plastomeric mix having bituminous nature. The membrane has a lower face, i.e. that which in use is arranged below, suitable for sticking to the surface to be waterproofed after flame heating on place. More precisely, the laying of the waterproof membrane is carried out starting from rolls of membrane unwound after flame heating of the lower face, with propane heating torch, operating substantially on a generatrix of the roll being unwound. The heating step is carried out at a temperature of about 300°C and has the object of melting the bituminous lower face so that the mix after cooling forms a continuous bonding with the surface same.

[0016] It is known moreover that bituminous membranes are permeable to magnetic fields and are good electric insulators.

Summary of the invention

[0017] It is therefore object of the present invention to provide a method for making a bituminous coating that besides having waterproofing properties and good mechanical resistance against external agents has a magnetic effect, capable of solving the above problems and other problems of electrical, electromagnetic, magnetic type.

[0018] It is a first particular object of the present invention to provide a method for making a bituminous coating that is capable of shielding surfaces of buildings from electromagnetic radiation and that can be easily applicable both to new and existing buildings.

[0019] It is another object of the present invention to provide a waterproof bituminous coating applicable to surfaces of buildings for shielding the internal room from electromagnetic radiation without additional expensive works with respect to the known waterproofing techniques.

[0020] It is a first particular object of the present invention to provide a method for making a bituminous coating for shielding metallic structures, ducts, etc., from stray currents, which is easy to carry out and provides a permanent protection, as well as to provide a bituminous coating applicable to such metallic structures that carries out this method.

[0021] It is a further object of the present invention to provide a method for making a bituminous coating that is used as magnetic guide, in industrial and road surfaces.

[0022] These and other objects are achieved by the method according to the invention whose characteristic is to provide a bituminous coating in the form of bituminous membranes having for its all-extension at least an embedded layer of conductor material.

[0023] The production steps of the membranes comprise: unwinding at least a roll of reinforcing material; rolling said layer of reinforcing material through a storage stand of bituminous material, whereby on both the faces of said material are thus deposited layers of bituminous material, its characteristic being that the reinforcing material is a conductor material. In particular, said reinforcing material is a net obtained from knitting or weaving lead wire, or it is a thin perforated and stretched metal sheet.

[0024] According to a physical general aspect of the invention a bituminous membrane made directly on place, or prefabricated flat or wound in a roll, for waterproofing and insulating horizontal surfaces of buildings, or for shielding structures from stray currents, or for making magnetic guides or for other uses with electrical and/or magnetic effect, is formed by a first face that sticks to the surface to coat and a second face facing towards the exterior, the membrane having the characteristic of being associated to at least a layer of conductor material that extends for all its surface.

[0025] The layer of conductor material is embedded in the matrix of the coating, advantageously about at the middle of its thickness.

[0026] The layer of conductor material embedded in the bituminous coating is preferably a net metal. The net can be made of knitted or woven metal lead wire or of thin perforated and stretched metal sheet. For the metal net knitted or woven a fibre can be used plated with highly conductor metals, for example inoxidizable precious metals.

[0027] The wire of the net is either made of or plated with metals chosen among: copper, aluminium, brass,

iron, nickel, steel, carbon, titanium, other metals or conductor metal alloys.

[0028] The maximum distance between two conductor wires of the net is set between 50µ and 30mm. The net can be formed by either all conductor wires or by conductor wires alternated to one or several not conductor wires.

[0029] In a first embodiment of the invention, all the net is embedded in the membrane. Longitudinally to the membrane and at the edges thereof the net is covered along both sides by a web in flexible material so that the net is insulated from the bituminous material. Furthermore, the membrane has advantageously transversal strips of flexible material, for example fabric impermeable to bitumen, which coats the net along transversal lines. By pulling with suitable shear movement the transversal and/or longitudinal flexible material it is possible, in use, to uncover strips of net at the longitudinal sides of the membranes and/or transversal strips of net, thus tearing the bituminous material that coats it and allowing an electrical connection with the adjacent membranes or a grounding.

[0030] In a second embodiment, not all the net is embedded in the membrane, and precisely a central portion of net is embedded in the membrane whereas a first and a second lateral edge of net protrudes from opposite sides not embedded in the membrane. Also a head or tail edge of the membranes can be uncovered.

[0031] The net edges not embedded in the membrane are electrically not insulated. When preparing the membrane before or after the laying step, the first edge of net is bent on the first face and the second edge on the second face. This way, laying a roll of membrane partially overlapping another membrane already stuck, it is possible to match the two net edges on one another, thus electrically connecting the nets of the two membranes.

[0032] In both the embodiments, by laying on a same surface to coat different membranes adjacent to one another, a single membrane and a single net electrically connected is substantially obtained.

[0033] According to a first physical particular aspect of the invention, for shielding buildings from electromagnetic waves the application to the surfaces of said buildings is provided of coating elements formed by said bituminous membranes. The conductor material embedded in the coating or membrane is grounded for completing the shielding. Furthermore, the conductor materials belonging to different coating elements are electrically connected to one another in order to form a single conductor to be grounded.

[0034] Another physical particular aspect of the invention is that of shielding metallic structures from stray currents, by applying to the surfaces of said structures waterproof coating elements formed by said bituminous membranes. The conductor material embedded in the coating or membrane is grounded for completing the shielding. Furthermore, the conductor materials belong-

ing to different coating elements are electrically connected to one another in order to form a single conductor to be grounded. If the surfaces to coat are tubular surfaces, for example for shielding ducts from stray currents, the bituminous membrane according to the invention has two uncovered net edges at opposite sides. The membrane, made of a strip of appropriate width, is wound helically, so that the two uncovered net edges match with each other.

[0035] The laying step on plane surfaces can be carried out in a normal way for bituminous membranes, by flame heating the face that sticks to the surface to shield. The longitudinal or transversal edges of the membranes are overlapping so that uncovered net edges of adjacent membranes selectively match with one another forming an electrical contact. Advantageously, the uncovered net edges can be coated with conductor paste, for example based on powder of graphite, copper, silver, aluminium embedded in a suitable pasty matrix that with heat produces a conductor linkage for the matching net edges, in order to assure a contact even where gaps are present.

[0036] In a different embodiment of the method of coupling the membranes, after the laying step of a first membrane that has a first edge of net uncovered, a second membrane is completely overlapped that has also an edge of net uncovered, so that the two edges match with each other. Then, the first and second membrane are united with a side seam applied on place that crosses the two edges. Finally, the second membrane is overturned about the seam with respect to the first membrane already stuck to the surface.

[0037] The membrane can be supplied in rolls unwound progressively and flame applied on the surfaces to be shielded. After cooling the first edge of net of a first membrane matches the second edge of net of a second membrane and the electrical contact is obtained. The overlapping step of the membranes is carried out similarly to the prior art membrane without net. Then, the heating of the bonding line between the two membranes is carried out by means of penetration of the molten bitumen also through the two overlapped net edges. This penetration does not affect the electrical contact that is already obtained between the two membranes.

[0038] In particular cases, the bituminous membrane can also be mounted on vertical surfaces.

[0039] According to a third physical aspect of the invention, magnetic guides can be made by means of direct application on a road surface of a bituminous coating with magnetic effect. The coating, in the form of a membrane, is provided in rolls of not too much wide strip and having an embedded conductor material, in particular metal fabric net. The ends of the strip have uncovered net edges that overlap to each other forming the continuity of the conductor, for example with the aid of bonding by heating or with chemical pastes. Voltage is applied to portions of predetermined length of strip that form a current path and then a magnetic guide. The

method of use of the coating according to the invention is particularly effective since the laying step of the web can be done very quickly and also with an appropriate equipment, thus rapidly providing magnetic guides for long distances. The strength of the reinforced bitumen is like that known and used in bituminous membranes for road works and allows to the magnetic guide to bear even high compressive and shear stress.

10 Brief description of the drawings

[0040] Further characteristics and the advantages of the method for making a bituminous coating with electrical and/or magnetic effect, of the bituminous coating thus obtained and of its use according to the invention will be made clearer with the following description of an embodiment thereof, exemplifying but not limitative, with reference to the attached drawings, wherein:

- 20 - figure 1 shows a diagrammatical simplified view of the production of a bituminous membrane according to the present invention;
- 25 - figure 2 shows a top plan view of a net in fabric formed with lead wire and used for the production of the bituminous membrane of figure 1;
- 30 - figure 3 shows a cross sectional view of a membrane obtained with the process of figure 1;
- 35 - figure 4 shows a cross sectional view of a different embodiment of a bituminous membrane obtained with the process of figure 1 suitably modified;
- 40 - figure 5 shows a step of tearing away a side portion from the bituminous membrane of figure 4 to uncover edges of conductor metal net;
- 45 - figure 6 shows a perspective view of an unwinding step of a bituminous membrane with the uncovering steps of longitudinal and transversal strips of conductor net;
- 50 - figure 7 shows a step of mechanical and electrical coupling of two bituminous membranes according to the invention with the electrical matching to each other and relative grounding;
- 55 - figures 8 and 9 show a perspective view of a different embodiment of a bituminous membrane according to the invention;
- 60 - figures 10 and 11 show the bituminous membrane of figures 8 and 9 with the side edges of conductor net bent laterally towards opposite sides;
- 65 - figure 12 shows a step of coupling two bituminous membranes like those of figures from 8 to 11;
- 70 - figures from 13 to 15 show a third different embodiment of the step of mechanical and electrical coupling of two bituminous adjacent membranes, with the overlapping, seaming and overturning steps of the upper membrane with respect to the lower;
- 75 - figure 16 shows a step of coating a roof of a building with a membrane according to the invention;
- 80 - figure 17 shows a step of coating a metal tube with a bituminous membrane according to the invention;

figure 18 shows the method of making a magnetic guide by means of a membrane according to the invention.

Description of a preferred embodiment

[0041] With reference to figure 1, a bituminous coating 1, in the form of a bituminous membrane, is produced in a plant 2 of known type.

[0042] More precisely, the production steps of membrane 1 provide the unwinding of at least a roll 5 of two-dimensional material 3 that is rolled through stands 4 and sunk in bituminous material. This way, on both faces of the two-dimensional material 3 layers of bituminous material are thus deposited. Membrane 1 is then wound forming a roll 7.

[0043] Normally, the two-dimensional material 3 has the function of a reinforcing material for membrane 1, and is completely embedded in the bituminous matrix.

[0044] According to the invention, the two-dimensional material 3 is a conductor material. It can be made of a net 13 obtained by knitting or weaving, like that shown in figure 2, with wires of weft 14 and warp 15. Wires 14 and 15 can be wires of conductor metal chosen among: copper, aluminium, brass, iron, nickel, steel, carbon, titanium, other metals or conductor metal alloys. Alternatively can be used textile thread, plastic or metal wire with not high conduction (for example steel) plated exteriorly with highly conductor metals, for example copper or inoxidizable precious metals.

[0045] The thickness of the wire, according to different uses, can be varied from 30 µ to 2 mm. The maximum distance 6 between conductor wires of a mesh of the net is preferably set between 50 µ and 30 mm. It is possible also to alternate conductor wires of weft 14 or of warp 15 to not conductor wires.

[0046] Alternatively to the net of metal knitted wire, the two-dimensional material 3 can be made of woven net, always in lead wire, or of thin perforated and stretched sheet.

[0047] A result of the production of bituminous membrane according to the invention is shown in the cross sectional view of figure 3, wherein with the numeral 11 the bituminous matrix has been indicated in which net 13 with wires of weft 14 and wires of warp 15 is embedded. Net 13 is embedded in matrix 11 of membrane 1 about at the middle of its thickness.

[0048] Membrane 1 thus obtained, besides having waterproof properties completely equal to the normal bituminous membranes, is also reinforced by the mechanical resistance of the conductor material 3, in particular net 13, and owing to the conductive properties of net 13 same it has also electromagnetic, magnetic and electric properties; that the normal waterproof bituminous membranes do not have.

[0049] The use of membrane 1 according to the invention can be done in many ways described hereinafter, exploiting the characteristics of electromagnetic in-

duction of the conductor metal of the net, both in passive way, such as for shielding electromagnetic waves or neutralising stray currents, and in an active way, such as to provide magnetic guides.

[0050] With reference to figures from 4 to 7, in a first embodiment of the invention all net 13 is embedded in matrix 11 of membrane 1. In order to carry out the electric connection, such as grounding, electrical connection to adjacent membranes, or the connection to voltage sources, it is necessary to uncover portions of net so that they are not electrically insulated.

[0051] As shown in figure 4, at the edges of membrane 1 net 13 is covered at both sides by a strip 20 in flexible material, which insulates them enough from the bituminous material 11. Strip 20 can be for example waterproof fabric, for example cloth. Or can be a extruded resin, or also an insulated linen finished strip. Strip 20, having enough mechanical resistance, can be torn away on place by the operator so that side edges 13a and 13b of net 13 are uncovered, thus removing corresponding portions of bituminous matrix 11a and 11b.

[0052] Also transversally, in the direction of the weft of net 13, transversal strips of fabric 21 can be provided which, when torn away, remove portions 11c of bituminous matrix, thus uncovering a portion of net 13c (figure 6). The portions of uncovered net 13c, at a single or even at both the ends of membrane 1, allow the operator to cut the membrane and join it for creating an electrical connection with a previous or following membrane.

[0053] Both for the longitudinal uncovered portions of net 13a and 13b, and for the transversal portions of uncovered net 13c, it is possible to form a bonding line as shown in figure 7. More precisely, it is sufficient to couple the membrane by matching an uncovered edge of net 13a at a side membrane 1a, with an edge of uncovered net 13b at the opposite side of membrane 1b. The corresponding removed portions of bituminous matrix 11a and 11b (figure 5) allow that the overall thickness along the longitudinal bonding line is not increased. A similar step can be done for the head or tail junctions, provided that transversal net edges 13c are uncovered by removing portions 11c at the opposite longitudinal ends of membrane 1a and 1b.

[0054] Preferably, on uncovered net edges 13a, 13b or 13c a conductor substance is applied, such as a mixture or gel for example based on powder of graphite, copper, silver, aluminium embedded in a suitable paste or gelatinous matrix. This way, by flame heating membrane 1 according to arrows 18 of figure 6 during the application step to surface 19 to coat, the conductor substance forms after heating a conductor link at the matching net edges 13a, 13b or 13c, so that a contact is assured even where physical gaps are present. Obviously, a correct pressing step of membrane 1a and 1b on surface 19 improves contact between metal and metal of the two net edges and, with the aid of the conductor substance, a steady contact for all the length of net edges 13a, 13b or 13c is obtained. A successive penetration

of the bituminous material does not affect the continuous electric contact between net edges 13a, 13b or 13c.

[0055] With reference to figures from 8 to 12, in a different embodiment of the invention net 13, instead of being all embedded in bituminous matrix 11, has edges 13a and 13b already free from bitumen at the end of the production step of figure 1. This can be obtained by masking the net during the sinking step in the bitumen within stands 2, or by the application of templates then removed before or after winding in roll, as well as by hot washing and degreasing the net edges. In every case, it is important that the uncovered net edges 13a, 13b are eventually electrically not insulated. Also a transversal of head and/or tail edge of membrane 1 can be uncovered.

[0056] The roll 7 of membrane can be formed directly as shown in figures 10 and 11, with a first edge of net 13a bent onto the first face and a second edge 13b bent onto the second face membrane 1. This way, as shown in figure 12 laying a membrane 1a partially overlapping to another membrane 1b already stuck, it is possible to match the two edges of conductor net 13a and 13b on one another, thus electrically connecting the nets 13 of the two membranes 1a and 1b. In figure 12, as also in some of previous figures, membrane 1a and 1b are shown with the omission of a central part, for graphic reasons. Furthermore, the thickness of membranes has been increased with respect to the actual one. Normally a bituminous membrane has a thickness set between 2 mm to 1 cm.

[0057] With reference to figures from 13 to 15, a different embodiment of the method of coupling the membranes provides that, after the laying step of a first membrane 1a, with an first uncovered net edge 13a, a second membrane 1b is completely overlapped having also a second uncovered net edge 13b, so that the two edges 13a and 13b are parallel to each other (figure 13). Then, the first and second membrane are jointed with a lateral seaming or welding 22, carried out on place, that crosses the two edges 13a and 13b (figure 14). Finally, second membrane 1b is overturned about line 22 about the already stuck first membrane 1a, as shown in figure 15.

[0058] In all the examples of figures 7, 12 and 15, laying a plurality of membranes 1 on a same surface to coat a substantially single membrane and then a single electrically connected net are eventually obtained.

[0059] With reference to figure 16, for shielding the roof 31 of a building 30 from electromagnetic waves it is possible the application in the way above described of a plurality of membranes 1 all electrically connected at the side and end edges, so that a single membrane 100 is formed. The conductor material of nets 13 associated to membranes 1 that is located along the perimeter of membrane 100 is grounded, for example to a gutter 32, for completing the shielding. Through the electrical connections between adjacent membranes like that shown in figures 7, 12 and 15, also the net 13 belonging to different adjacent membranes 1 is linked electrically

in order to form a single conductor in turn grounded.

[0060] To shield high frequency electromagnetic waves, for example about 800MHz-1GHz like those of cellular telephones, it is preferential that net 13, has a diameter ϕ (fig. 2) of about 150-300 μ . This can be obtained using a woven net of conductor wire with the diameter of 30-100 μ . For shielding from lower frequency fields it is possible to use a net having meshes with wider width.

[0061] The application of prefabricated membranes can be substituted by making the membranes on place, by applying bituminous layers directly with the interposition of net 13, suitably linked to adjacent nets and grounded.

[0062] According to another physical particular aspect of the invention, shown in figure 17, a duct in steel 40 can be shielded from stray currents. More precisely, a bituminous membrane 1 large for example 10-30 cm can be applied helically, with side edges 13a and 13b uncovered in the same way shown in figures from 4 to 7. A single membrane tubular 41 is thus formed and, internally to it, a single metal tubular net completely insulated from tube 40 is provided. Advantageously, tube 40 can be rotated while progressively unwinding membrane 1.

[0063] The metal tubular net within membrane 41 is then grounded for completing the shielding without touching in any place the metal of tube 40 same. The variations of current in tube 40 by magnetic induction are picked up by the tubular net conductor of net 13 and, in the form of current they are discharged far from tube 40 same.

[0064] With reference to a third physical aspect of the invention, shown diagrammatically in figure 18, it is possible to provide a magnetic guide 50 for driving a self-propelled vehicle along a direction 51 on a surface of movement 52. More precisely, this can be achieved by applying directly to surface 52, for example a road surface or a path in an industrial plant, a strip of membrane 1 like that shown in figure 3. Membrane 1 is provided in rolls of web for example of 5-10 cm wide and having a net 13 embedded.

[0065] One of the ends of the magnetic guide 50, i.e. the head or tail edges of the web, is connected to a voltage supply 53 for generating driving currents that generate magnetic field lines that allow to determine direction 51. For obtaining appropriate length a plurality of portions of web can be connected in succession in the way shown for example in figure 7. Strip 50 can be applied easily to surface 52, such as a normal bituminous membrane.

[0066] The foregoing description of a specific embodiment will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adapta-

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Claims

- 5: Bituminous membrane with electrical and/or magnetic effect, for waterproofing and insulating horizontal surfaces of buildings, shielding metallic structures from stray currents, creating magnetic guides, or for other uses with electrical and/or magnetic effect, characterised in that it comprises a**

- 12.** The use of a bituminous membrane (1) according to claims from 5 to 11, characterised in that it comprises the steps of: removing at least a portion (11a,

11c) of said coating (11) for uncovering at least a portion (13a, 13b, 13c) of said conductor material (3, 13), heat applying to a surface (19) at least a waterproofing element comprising said membrane (1), connecting of said uncovered portion (13a, 13b, 13c) to another external conductor or to a voltage supply (53) or to ground (32,42).

13. Use of a bituminous membrane according to claim 12 wherein, for shielding surfaces (30) of buildings (31) from electromagnetic waves, the total coating is provided of said surfaces (30) by means of a plurality (100) of adjacent elements formed by said membrane (1), the conductor materials (3) belonging to different waterproofing elements (1) being electrically connected to one another in order to form a single conductor to be grounded (32).

14. Use of a bituminous membrane according to claim 12 wherein, for shielding metallic structures (40) from stray currents, the total coating (41) is provided of the surfaces of said structures by means of waterproofing elements formed by said bituminous membrane, the conductor materials (13) belonging to said waterproofing elements (1) being electrically connected to one another (13a, 13b) in order to form a single conductor (13) to be grounded (42).

15. Use of a bituminous membrane according to claim 14, wherein said surfaces to coat are tubular surfaces (40), each of said elements having two edges (13a, 13b) of net (13) uncovered from opposite sides and being helically wound on said tubular surfaces (40) so that said uncovered net edges (13a, 13b) match with each other along helical lines.

16. Use of a bituminous membrane according to claim 12, wherein, for making a magnetic guide (51) on a surface (52) on which a self propelled vehicle can run, a step is provided of direct application on said surface of said membrane (50) in the form of a strip, the ends of said strip having uncovered net edges (13c) that overlap to each other forming a continue succession of sections, said continue succession of sections being supplied with voltage (53) and accordingly crossed by electric current thus forming said magnetic guide (51).

17. Method of use of a bituminous membrane according to claims from 12 to 16, wherein the longitudinal and/or transversal edges of said membrane (1) are overlapping each other so that uncovered net edges (13a, 13b) of adjacent membranes (1a, 1b) selectively match one another forming an electrical contact, a step being provided of coating said uncovered edges (13a, 13b, 13c) of net (13) by means of a conductor paste chosen among powder of graphite, copper, silver, aluminium embedded in a

pasty matrix or a gel that by hot application (18) forms a conductor linkage at said matching net edges.

18. Method of use of a bituminous membrane according to claim 17, wherein after the laying step of a first membrane (1a), having a first an uncovered edge (13a) of net (13), a second membrane (1b) having also an uncovered edge (13b) of net (13) is completely overlapped thereon, so that the two edges match with each other, the further step being provided of jointing said edges (13a, 13b) with a seaming or welding line (22), at the end of said jointing step said second membrane (1b) being overturned about said already stuck first membrane (1a).

[illegible][illegible][illegible]

14

[illegible]

FIG. 4

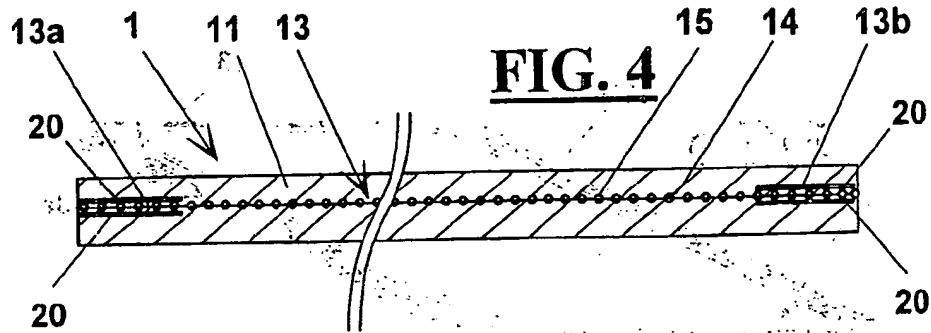


FIG. 5

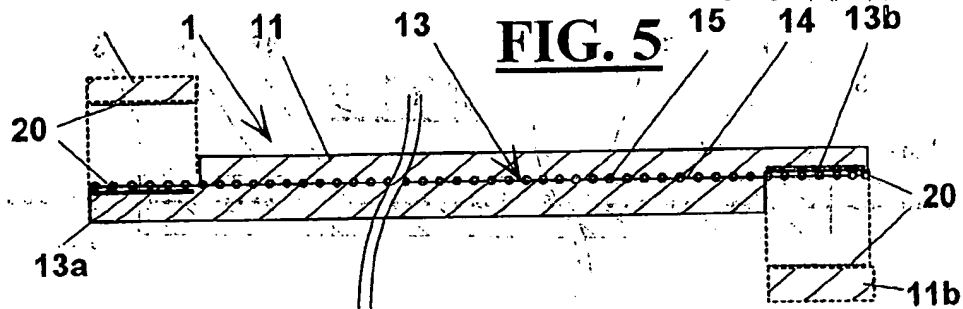


FIG. 6

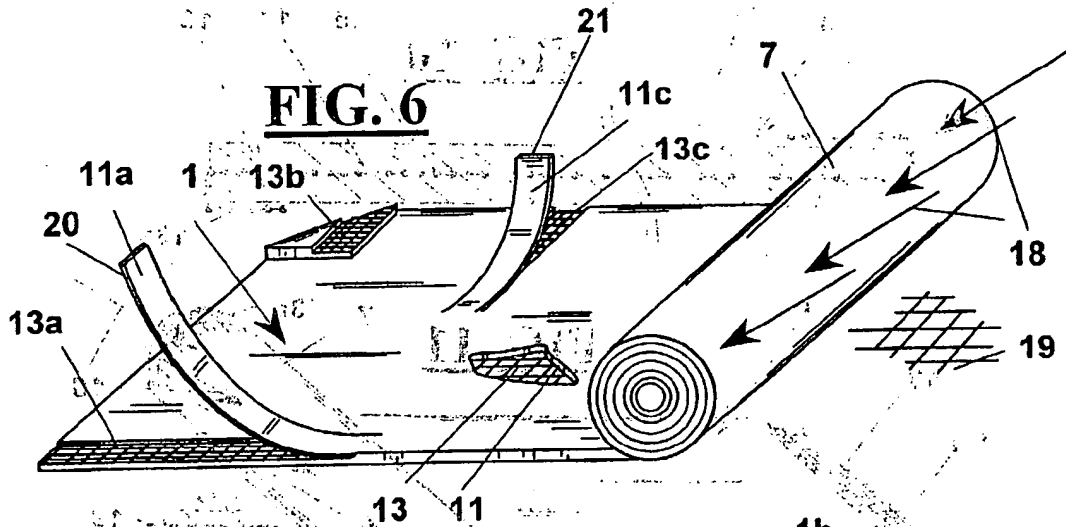
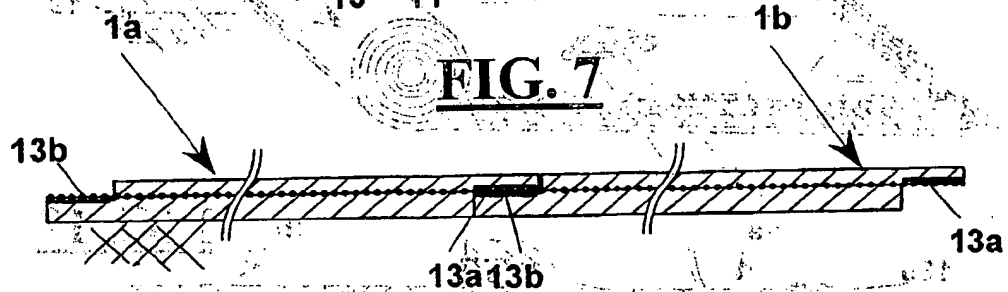


FIG. 7



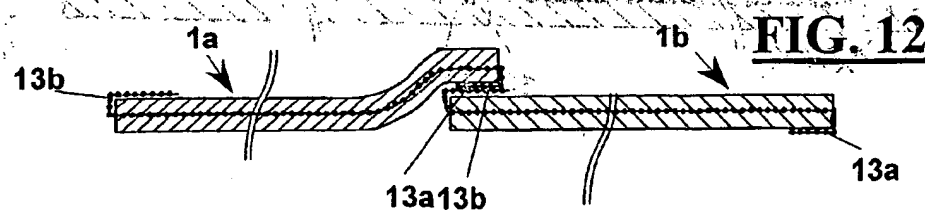
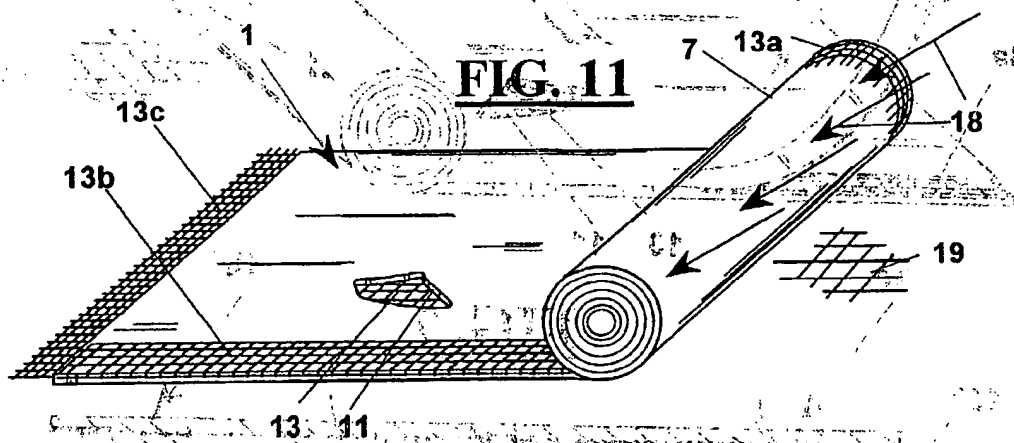
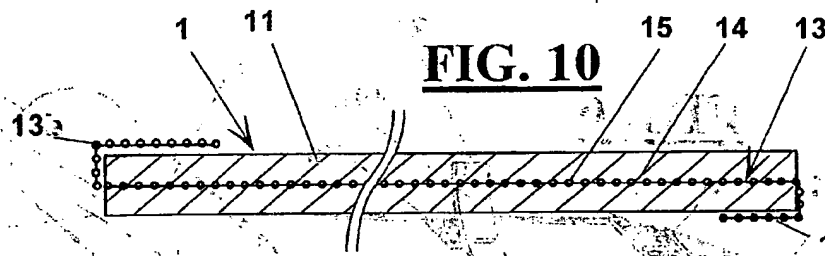
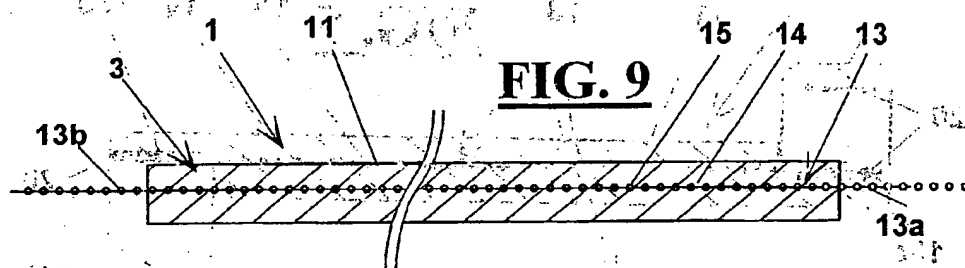
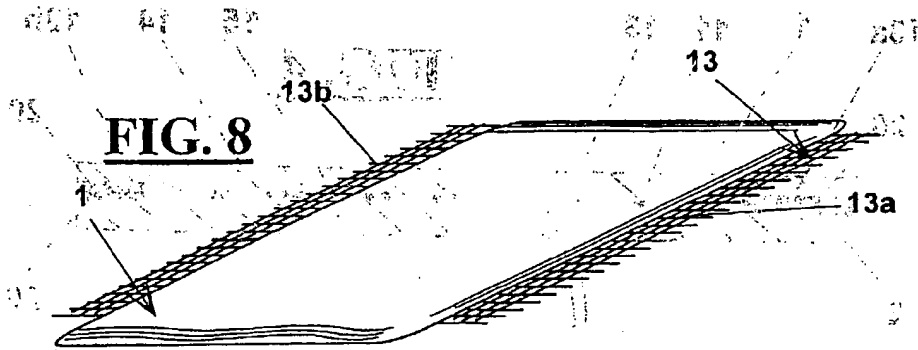


FIG. 13

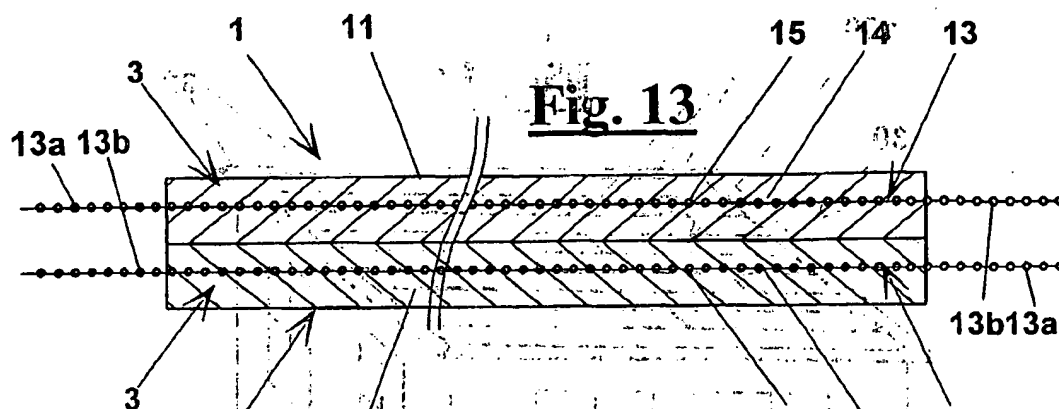


Fig. 14

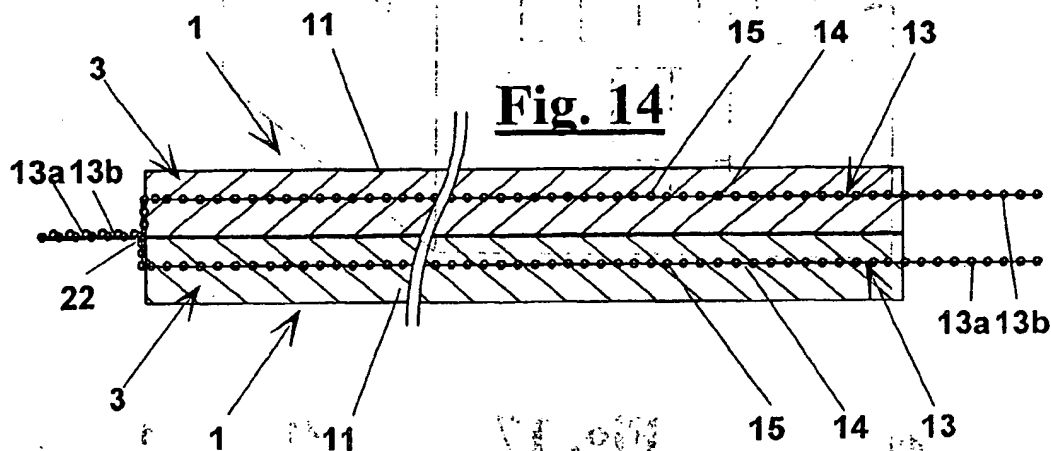
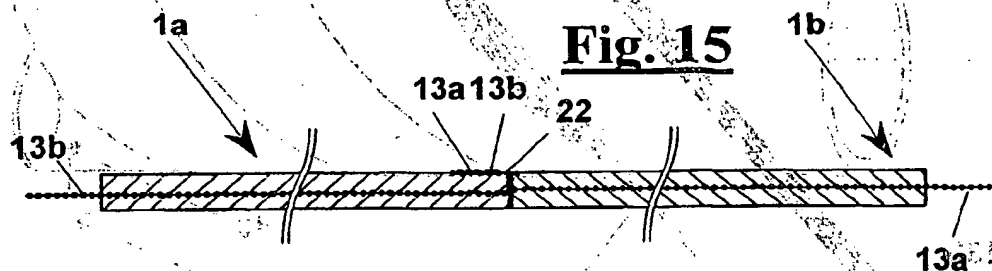
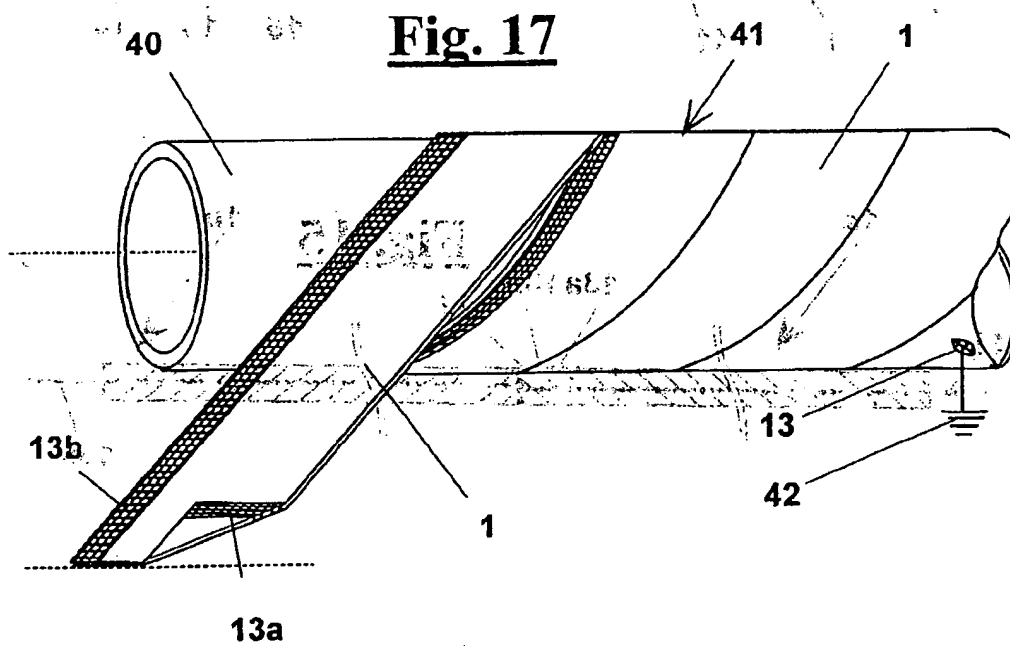
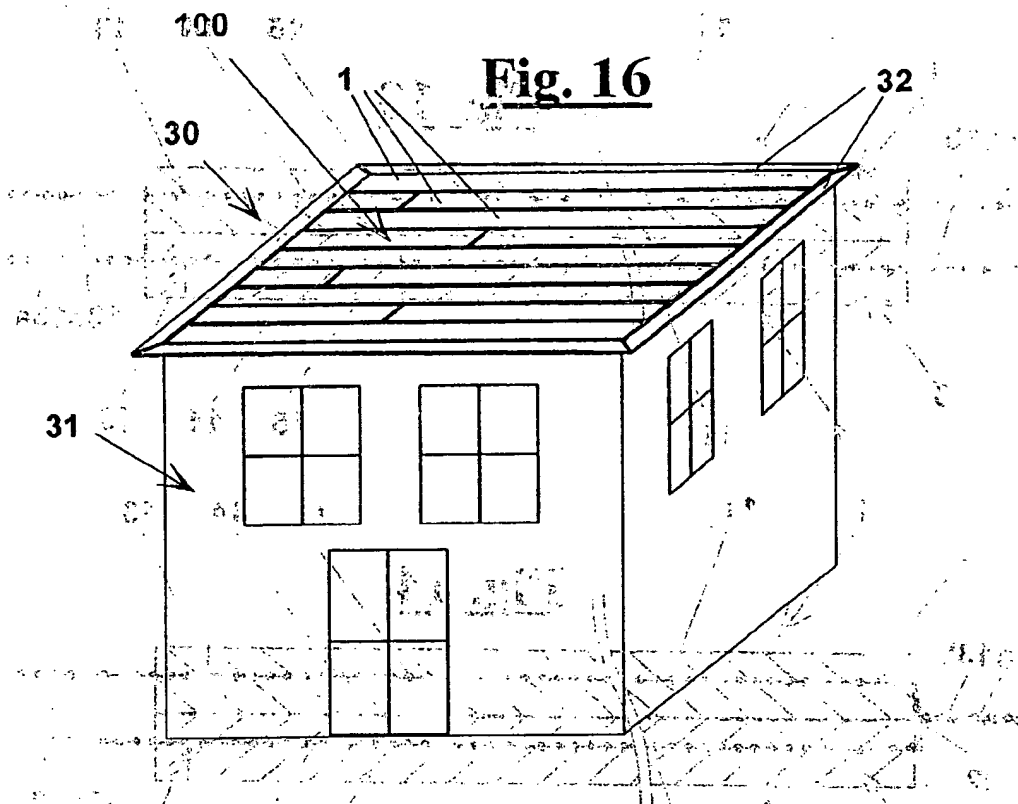
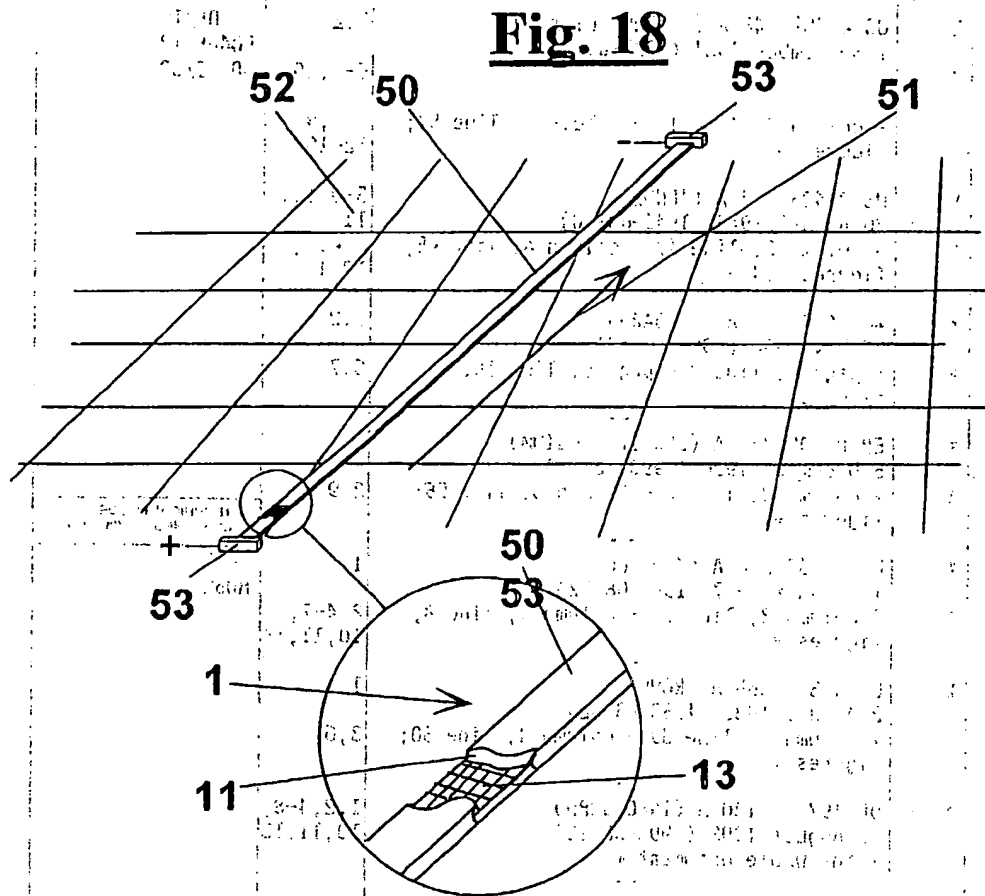


Fig. 15







EP 1 096 077 A1



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0687

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 287 248 A (GELSNER ET AL.) 1 September 1981 (1981-09-01)	1,2	E04D5/10 E04D5/12 H05K9/00
Y		5-8,10,11	
A	* column 3, line 12 - column 5, line 57; figures *	3,4,9,12-18	
Y	US 2 405 987 A (ARNOLD) 20 August 1946 (1946-08-20)	5-8,10,11	
A	* column 2, line 47 - column 4, line 45; figures 3,4 *	1-4,9,12-18	
X	WO 90 05223 A (CORDARO) 17 May 1990 (1990-05-17)	1,2	
A	* page 3, line 7 - page 5, line 15; figures *	6,7	
X	EP 0 400 711 A (DERBIT BELGIUM) 5 December 1990 (1990-12-05)	1	
A	* column 2, line 5 - column 3, line 55; figures *	2,9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X	US 5 656 354 A (KAULICH) 12 August 1997 (1997-08-12)	1	E04D H05K
A	* column 2, line 39 - column 4, line 8; figures *	2,4-7,10,11,14	
X	US 4 396 665 A (ROWE) 2 August 1983 (1983-08-02)	1	
A	* column 2, line 39 - column 4, line 50; figures *	3,6	
A	DE 197 05 180 A (ISPO GMBH) 13 August 1998 (1998-08-13) * the whole document *	1,2,4-8,10,11,13	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 April 2000	Examiner Righetti, R
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/85 (P46C31)



IN THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

EP 99 83 0687

PO FORM 1503 03.82 (P04C01)

EP 1 096 077 A1

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 83 0687

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4287248 A	01-09-1981	DE 2827136 A AT 41 T CA 1132896 A DK 257679 A, B EP 0006189 A FI 791950 A, B NO 702065 A, B	03-01-1980 15-05-1981 05-10-1982 22-12-1979 09-01-1980 22-12-1979 27-12-1979
US 2405987 A	20-08-1946	NONE	
WO 9005223 A	17-05-1990	IT 1235062 B AT 89629 T EP 0409919 A	17-06-1992 15-06-1993 30-01-1991
EP 400711 A	05-12-1990	BE 1004036 A AT 199995857 T DE 69003872 D DE 69003872 T DK 400711 T ES 2045759 T	15-09-1992 15-10-1993 18-11-1993 05-05-1994 14-02-1994 16-01-1994
US 5656354 A	12-08-1997	DE 4344707 A AT 168627 T DE 59406493 D EP 0661153 A FI 946079 A JP 7205372 A NO 945016 A	29-06-1995 15-08-1998 27-08-1998 05-07-1995 28-06-1995 08-08-1995 28-06-1995
US 4396665 A	02-08-1983	AR 229094 A AU 547628 B AU 7087481 A BR 8103739 A CA 1168971 A GB 2078612 A, B HK 6785 A JP 57024757 A KR 8402475 B MY 2587 A NZ 197230 A PH 16528 A SG 78284 G ZA 8103361 A	15-06-1983 31-10-1985 24-12-1981 02-03-1982 12-06-1984 13-01-1982 01-02-1985 09-02-1982 31-12-1984 31-12-1987 16-12-1983 10-11-1983 26-04-1985 26-05-1982
DE 19705180 A	13-08-1998	WO 9835541 A	13-08-1998

EPO FORM P0199

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 99 83 0687

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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3544264 A	19-06-1987	NONE	
US 5000999 A	19-03-1991	DE 8808918 U	26-01-1989
		CA 1317537 A	11-05-1993
		DE 3885610 D	16-12-1993
		EP 0350541 A	17-01-1990
US 4306927 A	22-12-1981	US 4213487 A	22-07-1980
DE 3535807 A	17-04-1986	NONE	
WO 9208022 A	14-05-1992	SE 467418 B	13-07-1992
		SE 9003435 A	30-04-1992
EP 924363 A	23-06-1999	DE 19756846 A	01-07-1999
US 3297461 A	10-01-1967	BE 647566 A	31-08-1964
		FR 1391650 A	23-06-1965
		GB 1066995 A	

For more details about this annex see Official Journal of the European Patent Office, No. 12/82